

Development of a Centrifugal Hydrogen Pipeline Gas Compressor

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Concepts NREC
June 11, 2008

Project ID: PDP9

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Overview

Time Line

Start date: June 2008

End date: May 2011

Percent Complete: Just started

Barriers

Reliability - High

Hydrogen Energy Efficiency - > 98%

Capital Cost - < \$9 million/200,000 kg/day

Maintenance - < 3%/year of total capital investment

Hydrogen Purity – Zero contamination

Budget

Total project funding - \$3.75 million

DOE funding – \$ 3.0 million

Contractor - \$ 0.75 million

Funding received to date – Project not started

Partners

Praxair, Inc

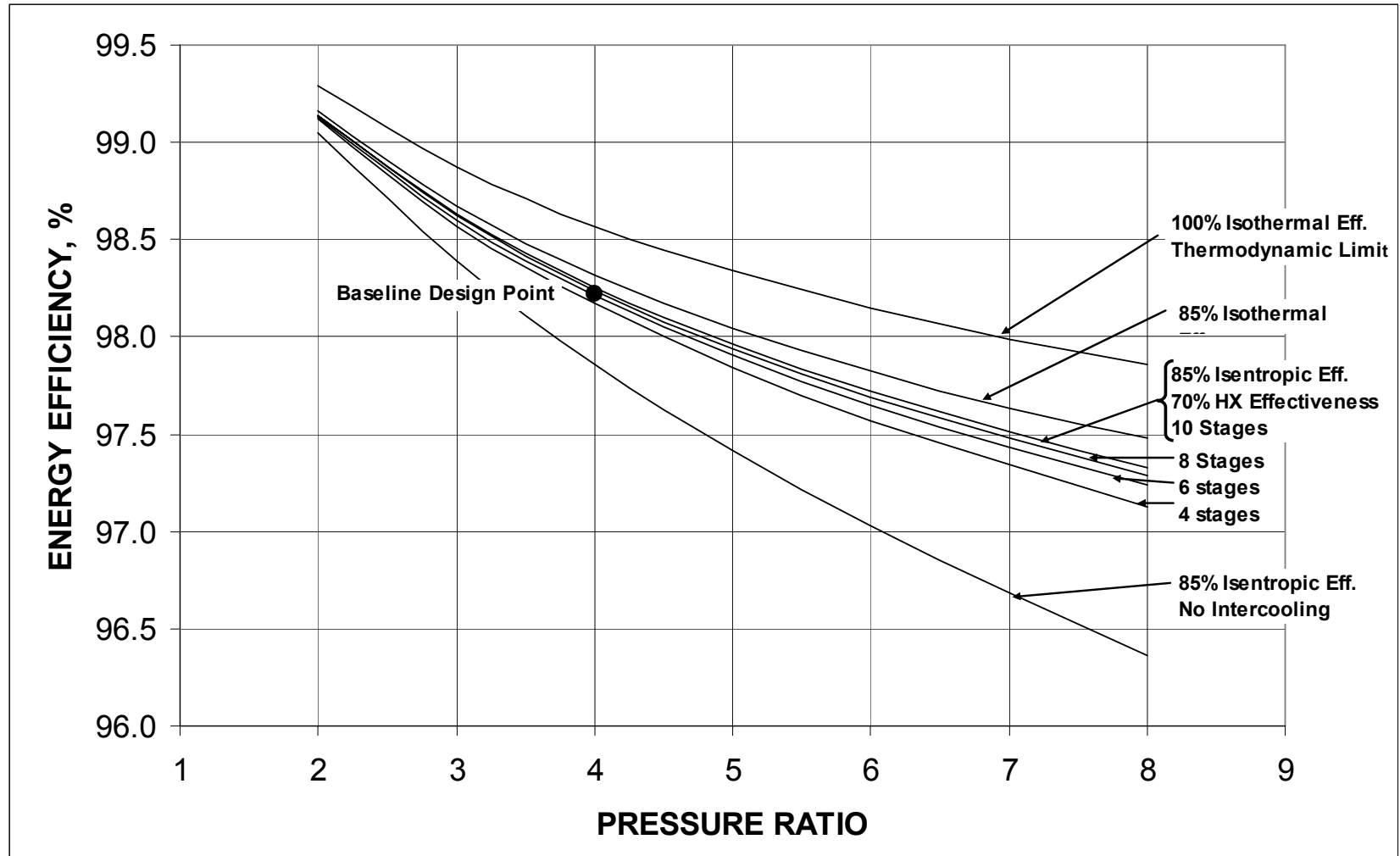
HyGen Industries

Texas A&M University

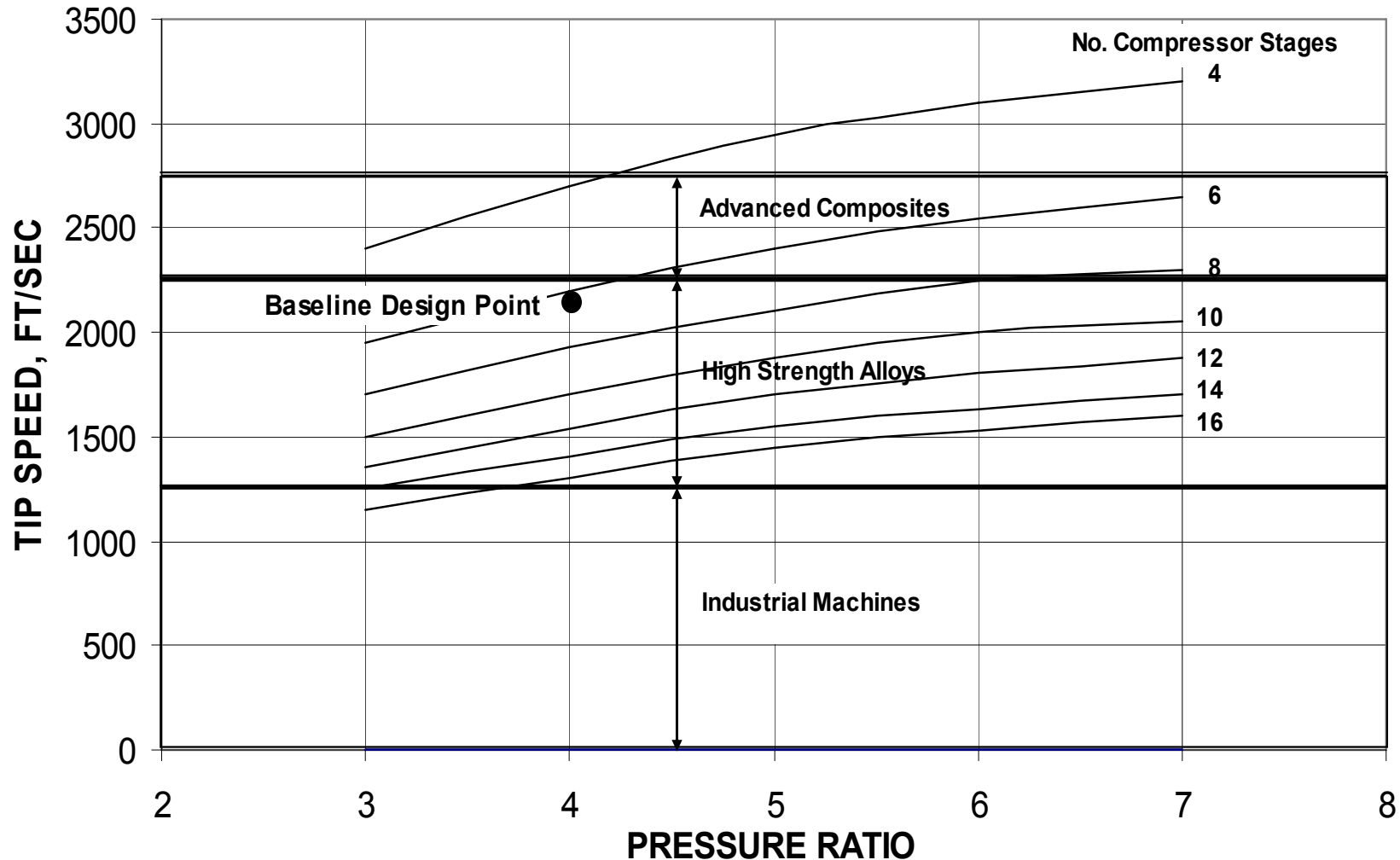
Objective

- Design and Demonstrate Advanced Centrifugal Compressor for High-Pressure Hydrogen Pipeline Transport
 - Investigate alternative system sizes, design options, operating conditions and costs
 - Select baseline design able to meet near-term applications
 - Identify critical areas of development and operational limitations
 - Design and test critical components under design conditions
 - Build and demonstrate full-scale components in an integrated compressor system
- Prepare Development Plan for Industrial Pipeline Application

Compressor Hydrogen Efficiency at Alternative Design and Operating Conditions



Generalized Design Limitations for Hydrogen Compression



Milestones

- August 2009 – Go/No-Go Decision – Alternative system designs reviewed and selection made of preferred approach. Materials and components testing will be completed and a material selected for compressor rotor.
- May 2010 - Go/No-Go Decision – Detailed design and cost analysis of full-scale pipeline system completed. Design of Laboratory Validation System finalized.
- June 2011 – Go/No-Go Decision – Fabrication and testing of two-stage Laboratory Validation System completed. Revised design and updated manufacturing cost analysis completed.

Approach

Initial Design

- Initial design criteria and performance specifications.
- Initial integrated systems design and cost analysis.
- Aerodynamic and structural analysis of compressor.
- Materials and/or coatings investigated for use in high-pressure hydrogen environment.
- Final design specifications.

Detailed Design

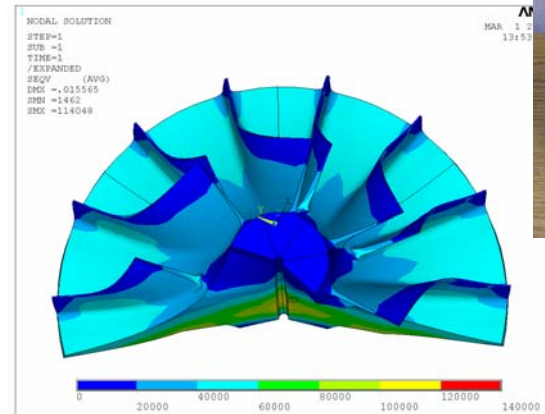
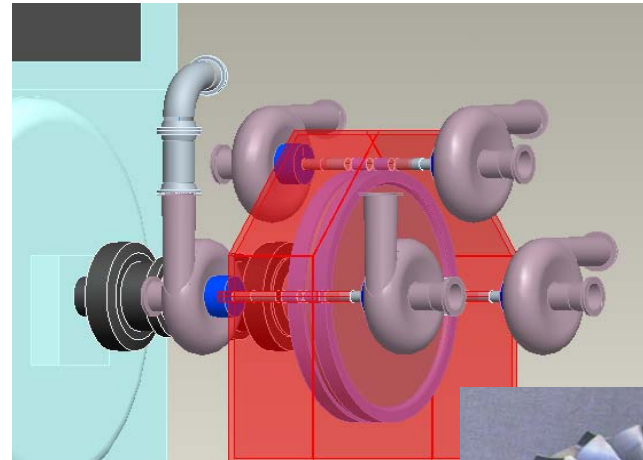
- Detailed integrated systems analysis.
- Critical components design and testing.
- Detailed design of full-scale and laboratory validation systems.
- Detailed cost analysis of full-scale system.

System Validation

- Two-stage centrifugal compressor system fabricated and tested to validate design.
- Final design of full-scale system completed.
- Field demonstration program plan prepared.

Program Accomplishments to Date

- Final contract negotiations in progress.
- Initial design approaches have been defined and a baseline concept has been established.



Future Work

- Complete contract negotiations.
- Prepare initial systems analysis to determine components/subsystems design specifications.
- Design compressor for high pressure ratio operation in hydrogen.
- Investigate and select materials for impeller design in a high-pressure hydrogen environment.

Summary

- Development program for efficient hydrogen pipeline compressor underway.
- Subcontractor team in place.
- Initial activities will focus on materials selection and compressor design.
 - Advanced aerodynamic and structural designs to minimize impeller stresses.
- Initial design specifications targeting current pipeline compressor requirements.
 - Provides for early introduction into the developing hydrogen pipeline infrastructure.